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ABSTRACT

A study was conducted at American River College during Spring 1981 to assess the effectiveness of a systematic desensitization program in reducing student anxiety toward chemistry and in improving student performance in chemistry courses. During the study, students in two sections of an introductory chemistry course were administered three tests at the beginning of the quarter: a questionnaire designed to measure student anxiety toward chemistry; two scales of the Alpert-Haber Achievement Anxiety Test; and a multiple-choice chemistry test. Based on test results, students were divided into a high anxiety group (HA) and a low anxiety group (LA). The high anxiety group was further divided into a control group (HAC) and a treatment group (HAT), each of which demonstrated statistically equivalent measures of chemistry anxiety. HAT students received desensitization cassettes for home use, which stressed relaxation techniques to be used during chemistry-related activities; HAC and LA students received no desensitization treatment. At the end of the quarter, all students were retested with the same instruments, and differences among the three student groups were statistically determined for: changes in pre- and post-test scores; dropout rates; and grades. Results suggest that desensitization reduces chemistry anxiety and contributes to improved classroom performance. The study report details methodology, limitations, and findings, and includes anxiety scales. (JP)

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Reducing Student Anxiety Toward Introductory Chemistry By Use of Systematic Desensitization

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ABSTRACT

Many college students who enroll in chemistry experience excessive anxiety which is course related. The literature contains many references for helping the test anxious and the mathophobics but relatively little for the chemistry anxious. The purpose of this study was to develop and evaluate the effectiveness of a self-administered, systematic desensitization program designed for reducing excessive anxiety toward an introductory chemistry course. At the beginning of the semester all students in two sections with different instructors were given a chemistry anxiety questionnaire. High anxious students (scores above median) were divided into treatment and control groups. Ending Ns were 25 in treatment (males = 5, females = 20, mean age 26.4 years) and 28 in a control group (males = 7, females 21, mean age = 22.0 years). Treatment subjects were given desensitization instructions on audio cassette tapes for home use. At the end of the semester all students were retested for anxiety including the original low anxious group. Treatment subjects reduced their anxiety more than controls ($P < .05$) while the low anxious group actually increased a small amount. The treatment group also did better in class as measured by total course points than did controls ($P < .05$). The class dropout rate was significantly higher for high anxious students than for low anxious ($P < .01$). The results suggest that systematic desensitization not only reduces excessive anxiety towards chemistry but may contribute toward higher classroom performance which in turn reinforces further reduction of anxiety.

Introductory chemistry has often earned the dubious distinction of being among the highest of anxiety provoking courses on many college campuses. No doubt this anxiety can be traced to inadequate student preparation in dealing with chemistry, unfamiliarity with symbols and mathematical calculations, as well as a host of various fear stimuli in the course (e.g., dangerous chemicals) not usually found outside the science departments. Much of the research literature linking excessive anxiety with specific college courses deals with mathophobia or general test taking.

Richardson and Suinn (1972) developed a mathematics anxiety rating scale (MARS) and report normative, reliability, and validity data for its use in treatment and research. Brush's study (1978) adds support for the reliability and validity of the instrument. Variables related to math anxiety in college students have been investigated by Betz (1978). She found excessive anxiety occurs frequently and is more likely seen among women and students with inadequate high school math preparation. Elmore & Vasu (1979) examined variables relating math anxiety to graduate level statistics achievement. Sex differences were found on math attitude scales, points in the course and on three of five spatial visualization subtests.

Treatment of mathophobia is usually by a variety of methods. Tobias & Donady (1977) describe a math clinic where counselors and math specialists work together to alleviate excessive anxiety. Curriculum and programming innovations were examined by Mathison (1977). She suggests that faculty are the most crucial variables since it has been found that respect for students, clarity of explanation, and clear but flexible goals have positive effects on student attitude toward math. Extensive mathophobia workshops were conducted at Allegheny County Community College (See Baylis, 1979). This two-year project

developed a model strategy for eliminating math anxiety and increasing basic mathematics skills in women. Evaluation of programs treating mathophobia has been summarized by Hendel (1977). The report points out the necessity of an intervention strategy that deals with both affective and cognitive aspects of the anxiety problem.

Desensitization therapy has been extensively used in treating test taking anxiety (Suinn, 1971; Suinn, Edie, Nicholetti and Spinelli, 1973). The latter group used a tape-recorded program without any other contact between experimenters and students in the treatment program. The desensitization program resulted in significant reduction of anxiety over controls that lasted over a six-month follow-up period. Romano & Cabianca (1978) compared EMG biofeedback training to systematic desensitization for test anxiety reduction. Results suggested that both methods are useful techniques, but that EMG biofeedback was not more effective than systematic desensitization. Cognitive behavior therapy and modeling for treating test anxiety was investigated by McCordick, Kaplan, Finn, and Smith (1979). The authors conclude that treated groups improved more than controls with rehearsal modeling ranking first among different treatment conditions. Harris & Johnson (1980) compared three different behavior treatments against controls in reducing test anxiety. The authors found that all treatment groups did better than controls on one or more dependent measures. Individualized covert modeling and self-control desensitization both substantially reduced self-reported test anxiety. Only the covert modeling group showed significant improvement in academic performance.

Only one article was uncovered in a computer search that touches upon the problem students have with excessive anxiety in a chemistry course, (Teachers Probe Trauma of Organic Chemistry, 1978). Yet it is the first author's

opinion that a considerable number of students do poorly in chemistry because of excessive anxiety. The authors developed a chemistry desensitization treatment program similar to one that yielded positive results with high anxious statistics students (Bartz, Amato, Pasor, and Rasor, 1979.) The problem was to determine if a self-administered, systematic desensitization program would be effective in reducing anxiety. The general hypothesis was that a treatment group of highly anxious students would outperform their untreated control counterparts in terms of classroom achievement.

Method

Near the end of the Spring 1980 semester over 100 introductory chemistry students at American River College at Sacramento, California, were surveyed regarding anxiety provoking situations and fear stimuli associated with chemistry. This particular course is designed for entry by students never having had a chemistry course or by those who need to update their high school chemistry knowledge before entering a specific major. The various items of fear producing stimuli were grouped and tallied for frequency and intensity. This resulted in 13 specific fear situations (See Appendix A). The authors then familiarized themselves with the fearful stimuli by taking tours through the chemistry facilities and by discussion with the chemistry instructors.[1]

Subjects

Students enrolled in two sections of introductory chemistry during the Fall 1980 semester at American River College served as subjects. Initial total enrollment was 178, but this was reduced by attrition to 128 after

[1] The authors are indebted to professors Ron Backus and Chuck Corwin for their generous time and support in this project.

33 drops and 17 cases of excessive missing data. There were a total of 47 males and 81 females with a mean age of 21.7 years. The high anxious treatment and control groups from this sample tended to be somewhat older and comprised of more females (Males = 12, Females = 41, Mean age = 24.1) compared with the low anxious group (Males = 35, Females = 40, Mean age 20.4).

Materials

Several materials were developed or adapted for use in this study.

1. An audio-cassette tape taken from a record by Liberman which gives instruction on deep muscle relaxation.

2. An audio-cassette describing fear provoking scenes encountered in chemistry along with instructions for relaxation and positive imagery. An example from the tape: "Imagine the laboratory, the tables, chairs -- all the equipment such as glass containers, bottles filled with chemicals, Bunsen burners, your locker, your classmates. See yourself exploring, touching the equipment -- looking at it in detail. Feel confident that you will not break anything -- that you know what you are doing. Note that this is the time for your lab. Now relax, deeply relax. Listen to the sounds of the ocean." Specific instructions on using the two cassettes that were given to students are shown as Appendix B.

3. A chemistry anxiety questionnaire consisting of 20 items developed by the first author. An example: "I start to feel tense when I read my chemistry book." Items are rated on a seven-point scale

ranging from very strongly disagree to very strongly agree. Maximum range from low to high anxiety is 20-140. The entire scale is shown as Appendix C.

4. Two scales of the Alpert-Haber Achievement Anxiety Test (AAT). Odd numbered items comprised the facilitating anxiety scale e.g., "Nervousness while taking a test helps me to do better," and even numbered items made up the debilitating anxiety scale, e.g., "The more important the examination, the less well I seem to do." (See Appendix D)

5. A chemistry knowledge test consisting of 50 multiple-choice items was prepared by the two instructors whose chemistry students were subjects in this study. This particular test was not used in course achievement evaluation.

Procedure.

Approximately 10 days after the start of Fall 1980 semester, students in both sections of chemistry were administered all testing materials. The combined median on chemistry anxiety was used as a cutoff for dividing the sample into high anxious and low anxious groups. The high anxious group was then subdivided into two matched groups of 42 members each, high anxious treatment (HAT) and high anxious control (HAC). Statistical analysis showed the two groups to be equivalent with respect to chemistry anxiety. A week later the desensitization cassettes were given to the HAT group along with instructions for its use. No one received specific anxiety score feedback. Hence, the control and low anxious groups had no knowledge of their group identity - only that they were not selected for treatment. Initially all students had indicated their willingness to use the materials if selected for treatment. Furthermore, the group identity of students was kept

unknown to the instructors throughout the entire study. The HAT members were followed up by phone at midsemester to determine if the materials were being used and whether treatment was working. On the last day of regular class, but before final exams, all students were retested with the chemistry knowledge exam and the anxiety scales. Additional information on the use of the cassettes was gathered from the HAT group. Later, each student's total points in the course was obtained from the instructors along with pertinent information about dropouts.

Results and Discussion

Two problems immediately became apparent after the second testing. First, to our surprise there were several absences which resulted in considerable missing data. Because only a period for the final exam remained during this semester, no subsequent testing could be done. Thus, what data were missing had to remain that way. Second, the instructors used some of the last regular class period for instructional purposes causing a shortage of time for the chemistry knowledge test to be administered. Also, students had been working with calculators all semester but were denied them when retested because they did not use calculators on the first testing. This caused some anger and obvious incomplete chemistry knowledge answer sheets. It was decided that where there were five or more missing scores, the student would be excluded from the ending data pool. Further, statistical analysis would still be done on chemistry knowledge scores but because of the difficulties, lesser importance would be given to that measure as a dependent variable. Total attrition from all sources reduced the ending sample sizes to HAT=25, HAC=28, LA=75.

Dropouts

There were no differences in the class drop rate between HAT and HAC, both being 12 students out of the original 42 in each of the two groups. However, the combined high anxious drop rate is significantly greater than the low anxiety group, where only nine dropped out of the original, $\chi^2(1) = 10.59$, $P < .01$. Unfortunately, no follow-up was done to determine if dropouts from the HAT group had ever listened to the desensitization materials.

Equivalency of groups

On the beginning chemistry knowledge test there were no significant differences among the groups which comprised the ending samples. (See Table 1). Also, there were no significant differences on beginning chemistry anxiety for HAT vs. HAC groups (See Table 2). Thus, the initial matching process still held through attrition.

Anxiety Reduction

The HAT and HAC groups both reduced self-claimed chemistry anxiety while the LA group increased slightly. Moreover, the HAT group had a significantly greater decrease in anxiety than the HAC group, t (42) = 2.07, $P < .05$. (Also see Table 3). Naturally some of this reduction could be due to demand characteristics in that students in the treatment group had awareness of what was expected of them. The authors did tell all students before filling out the ending anxiety questionnaires not to give results which they thought would please or displease us. None-the-less, this variable was not controlled.

Ending Chemistry Knowledge

As previously stated, there were problems in the second administration of this test. While there was a considerable difference between groups, F (2,105) = 7.87, $P < .001$, the only pair of means reaching significance was between HAC and LA. Means, SD's for these data are presented in Table 4.

TABLE 1

Initial Chemistry Knowledge for High Anxious Treatment, High Anxious Controls, and Low Anxious Groups

Group	N	Mean	SD
HAT	25	13.92	4.27
HAC	28	12.79	4.86
LA	75	14.89	3.51

TABLE 2

Initial Chemistry Anxiety for High Anxious Treatment and High Anxious Control Groups

Group	N	Mean	SD	Range	t
HAT	25	87.36	15.22	72-133	.22
HAC	28	86.50	12.99	72-128	

TABLE 3

Chemistry Anxiety Change Scores for Three Groups*

	HAT	HAC	LA
Mean	-18.26	-7.39	+2.22
SD	16.10	18.50	17.58
N	21	23	60

*Change scores = Ending anxiety minus initial anxiety

TABLE 4

Ending Chemistry Knowledge Data for Three Groups

	HAE	HAC	LA
Mean	22.19	20.16	24.92
SD	5.46	4.84	5.34
N	21	25	62

Total Points In Course

Both instructors used a 1,000-point scale for grading purposes, but there were some differences between instructors on what students had to do in order to earn points. It was for this reason that initially the two sections of chemistry had to be analyzed separately. In Table 5 are presented the means and SD's of total points for both instructors (sections). A more graphic illustration is presented as Figure 1. Clearly the LA group comes out a bit ahead of the HAT group, but not significantly so, while the HAC group trails far behind. This outcome was true for both instructors without there being any significant interaction. Because the phenomena held across instructors, we felt justified in combining both sections into one. This was accomplished by transforming raw data (per instructor) into standard scores. The transformation formula is given below for each instructor:

$$\frac{X - M}{SD} (100) + 500$$

where:

X = a score (total points) for an individual

M = mean of a class

SD= standard deviation of a class

Instructor 1 $\quad \frac{X - 824.93}{96.14} (100) + 500$

Instructor 2 $\quad \frac{X - 786.53}{95.41} (100) + 500$

The transformed score data for each group are presented in Table 6. A summary analysis of variance table on transformed scores is presented as Table 7. Planned comparisons revealed significant differences between HAT vs. HAC

TABLE 5

Final Points in Introductory Chemistry

By Instructor and Group (P = 1000)

	HAT	HAC	LA	TOTAL (all groups)
Instructor 1				
Mean	820.44	764.07	848.60	824.93
SD	95.93	108.44	83.15	96.14
N	18	15	42	75
Instructor 2				
Mean	790.14	728.31	808.70	786.53
SD	76.53	77.98	97.61	95.41
N	7	13	33	53

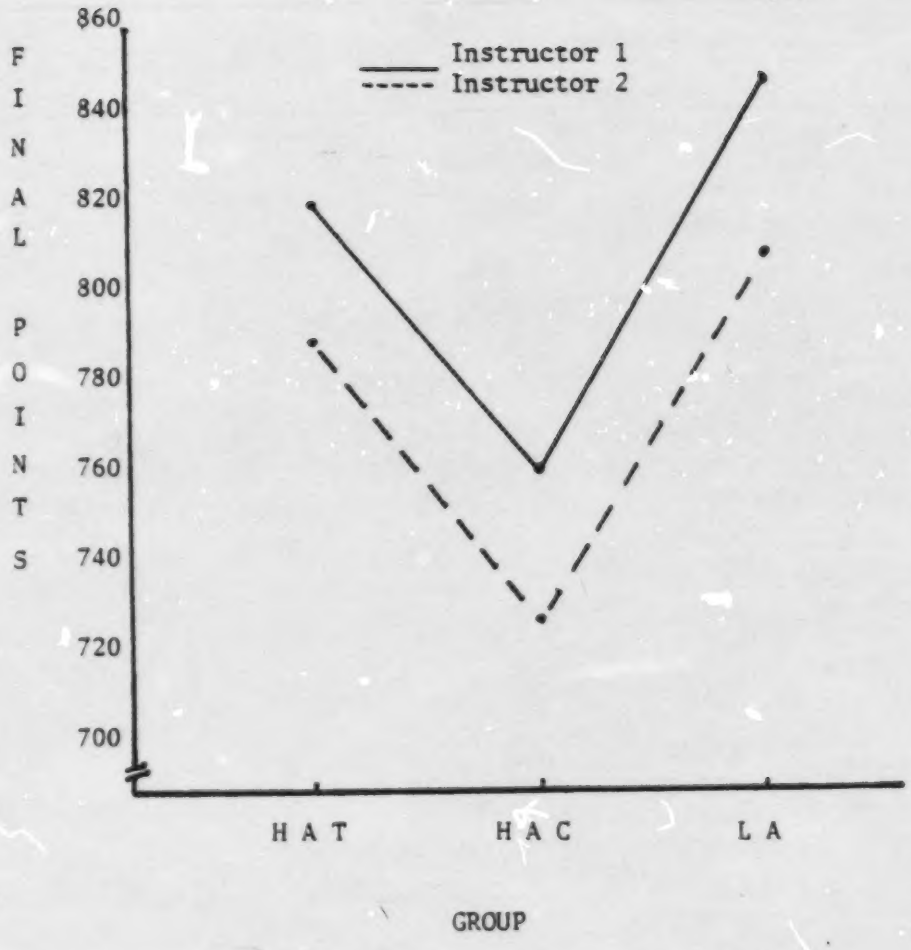

Figure 1. Final Points Earned in Introductory Chemistry by Instructor by Group

TABLE 6

Introductory Chemistry Final Points By Group

After Transformation To Standard Scores Where

M = 500, SD = 100

	HAT	HAC	LA	Combined
Mean	489	438	5[illegible]	500
SD	93	98	93	100
N	25	28	75	128

TABLE 7

Analysis of Variance on Transformed

Introductory Chemistry Course Points

Source	SS	df	MS	F
Treatment	151848.66	2	75924.33	8.56*
Within	1108153.54	125	8865.23	
Total	1260002.20	127		

*$P < .001$, $\eta^2 = .12$

groups, t (51) = 2.23, $P < .05$, and between LA vs HAC groups t (101) = 4.08, $P < .001$. The difference between HAT and LA groups was not significant. This clearly indicates that the untreated high anxious controls do the poorest on classroom measures, a finding consistent with data on anxious students taking elementary statistics (Bartz, et al., 1979).

In view of these findings, the hypothesis stating that high anxious students who receive desensitization treatment outperform untreated controls must be accepted.

Of secondary interest are correlational data between all variables (See Table 8). The highest predictors of total course points are ending chemistry knowledge (r = .60) and ending chemistry anxiety (r = -.59). These two variables combined predict course total points highly (multiple R = .71) accounting for 50 percent of the variance. In looking only at treatment and control group course points, knowledge of treatment alone accounts for 11 percent of the variance. Adding initial chemistry knowledge and initial chemistry anxiety scores into the equation only increases the R^2 value to .14.

In the overview, our results clearly suggest that reduction of excessive anxiety towards chemistry has beneficial effects in terms of classroom performance. One can raise the "chicken and egg" question however. Did listening to the desensitization tapes decrease anxiety and lead to higher course points, or did receiving intermediate feedback about higher course points lead to a reduction of anxiety with tape useage being incidental? Causal relationships are difficult to untangle with experimental designs conducted in a natural environment. Somehow the effects of feedback would have to be controlled to answer this question, but that was not possible in this study. At the least, we feel safe in saying that being in some treatment is better than being a control subject.

TABLE 8

Statistically Significant Intercorrelation Matrix For All Subjects*

Variable	Variable Number 1	2	3	4	5	6	7	8	9	10	11
1. Chemistry Knowledge 1**		.27	-.42					-.17	-.33	.19	.32
2. Chemistry Knowledge 2**			.76		-.19		.19	-.26	-.42		.60
3. Chemistry Knowledge Increase								-.16			.32
4. Debilitating Anxiety 1**					.54	-.49	-.37	.59	.20	.41	
5. Debilitating Anxiety 2**						-.18	-.52	.25	.40		
6. Facilitating Anxiety 1**							.53	-.43		-.45	
7. Facilitating Anxiety 2**								-.31	-.32		.17
8. Chemistry Anxiety 1**									.48	.57	-.24
9. Chemistry Anxiety 2**										-.44	-.59
10. Chemistry Anxiety Decrease											.28
11. Standard Score Final Points											

* All correlations are at least significant at the .05 level. All N's >100.
** Digits 1 & 2 indicate first and second (or ending) score.

The treatment group played their tapes an average of 5.4 hours (Median = 4.2 range = 1-36) and rated its value as fairly helpful (Median = 2.8 on a 4-point scale of "no help" to "very helpful"). As might be expected, tape useage and rating its helpfulness was significantly correlated, $r(21) = .39$, $P < .05$; but usage and amount of anxiety was not significant, $r(19) = -.17$, $P > .05$. It should be noted that three students who were originally designated as treatment subjects never bothered to play the tapes and were eliminated from the data pool.

Finally, a practical suggestion came from one of the chemistry instructors. He suggested that tighter control over degree of treatment could be accomplished by using part of the laboratory time near the beginning of the semester and having all high anxious volunteers receive treatment en masse.

REFERENCES

Alpert, R., & Haber, R. N. Anxiety in academic achievement situations. Journal of Abnormal and Social Psychology, 1960, 61, 207-215.

Bartz, W. R., Amato, P. R., Rasor, R. A., & Rasor, M. O. Effects of reducing student anxiety in a statistics course. Unpublished manuscript, 1979. (Available from first author, American River College, 4700 College Oak Drive, Sacramento, CA 95841).

Baylis, C. A. The mathophobia workship: A strategy for developing mathematical readiness for the academically disadvantaged student in career education. Monroeville, Pa.: Allegheny County Community College, 1979. (ERIC Document Reproduction Service No. ED 180522)

Betz, N. E. Prevalence, distribution, and correlates of math anxiety in college students. Journal of Counseling Psychology, 1978, 25, 441-448.

Brush, L. R. A validation study of the Mathematics Anxiety Rating Scale (MARS). Educational and Psychological Measurement, 1978, 38, 485-490

Elmore, P. B., & Vasu, E. S. Math anxiety: Its impact on graduate level statistics achievement. Paper presented at the annual meeting of the American Educational Research Association, San Francisco, April 1979. (ERIC Document Reproduction Service No. ED 178331)

REFERENCES (Continued)

Harris, G., & Johnson, S. B. Comparison of individualized covert modeling, self-control desensitization, and study skills training for alleviation of test anxiety. Journal of Consulting & Clinical Psychology, 1980, 48, 186-194.

Hendel, D. D. Evaluation of mathematics anxiety programs. Paper presented at the annual meeting of the American Psychological Association, San Francisco, August 1977. (ERIC Document Reproduction Service No. ED 155009)

Liberman, R. P. Teaching yourself to reduce or eliminate test anxiety. Newark, N. J.: Testing Studies Institute. (record)

Mathison, M. A. Curricular interventions and programming innovations for the reduction of mathematics anxiety. Paper presented at the annual convention of the American Psychological Association, San Francisco, August 1977. (Eric Document Reproduction Service No. ED 154330)

McCordick, S. M., Kaplan, R. M., Finn, M. E., & Smith, S. H. Cognitive behavior modification and modeling for test anxiety. Journal of Consulting & Clinical Psychology, 1979, 47, 419-420.

Richardson, F. C., & Suinn, R. M. The Mathematics Anxiety Rating Scale: psychometric data. Journal of Counseling Psychology, 1972, 19, 551-554.

REFERENCES (Continued)

Romano, J. L. & Cabianca W. A. EMG biofeedback training versus systematic desensitization for test anxiety reduction. Journal of Counseling Psychology, 1978, 25, 8-13.

Suinn, R. M. The application of short-term video-tape therapy for the treatment of test anxiety of college students. Final report. Ft. Collins, Colo.: Colorado State University, 1971. (ERIC Document Reporduction Service No. ED 070363)

Suinn, R. M., Edie, C., Nicoletti, J. & Spinelli, R. Automated short-term desensitization. Journal of College Student Personnel, 1973, 14, 471-476.

Teachers probe trauma of organic chemistry. Chemistry and Engineering News, September, 1978, P 32.

Tobias, S., & Donady, B. Counseling the math anxious. Journal of the NAWDAC, 1977, 41, 13-16.

APPENDIX A

SELECTED CATEGORIES OF FEAR STIMULI ASSOCIATED

WITH INTRODUCTORY CHEMISTRY

5 = Most anxious 1 = Least anxious N = Number of times mentioned

1. Being unfamiliar with the lab and afraid of breaking equipment.

   N = 21 Average 3.4

2. Afraid of not performing experiment correctly.

   N = 39 Average 3.7

3. Not being able to understand the material (book, lecture, or lab).

   N = 38 Average 3.7

4. Afraid of the first test.

   n = 24 Average 4.1

5. Being disrupted by others during the test.

   N = 18 Average 4.1

6. Being unprepared for lab, tests, or quizzes.

   N = 17 Average 3.8

7. Inability to memorize chemical formulas and equations.

   N = 15 Average 3.6

8. Having a test on Monday.

   N = 13 Average 3.5

9. Fear of dangerous chemicals and gases.

   N = 12 Average 3.3

10. Anxiety stemming from negative past experience with chemistry and related courses.

    N =10 Average 2.9

APPENDIX A (Continued)

11. Not being as good as other students in chemistry.

N = 9 Average 3.7

12. Announcing a test date.

N = 7 Average 3.0

13. Return to school after a prolonged absence.

N = 6 Average 3.0

APPENDIX B

CHEMISTRY ANXIETY TREATMENT

INSTRUCTIONS - PLEASE READ CAREFULLY

Thank you for agreeing to be in the chemistry anxiety reduction study. You were selected because of your relatively high anxiety score, your willingness to listen to some tapes and the fact that you have access to a cassette or are able to purchase a player. Beyond that, the treatment and control groups were randomly selected. In total, there are approximately forty people divided among Corwin's and Backus' clas[illegible]o will be using these tapes. There is an equivalent number who also [illegible] anxiety who will serve as a control group and will not receive th[illegible]. While members of the control group may feel left out, it is critica[illegible]hat such a control group be formed. Only be comparing your performance on anxiety reduction, chemistry knowledge (remember the test?) and points earned in class against the controls, can we effectively determine if the treatment plan is of any use. If all goes well, the tapes (and any refinement) will be made available to all students next semester.

The principle behind this treatment is relatively simple and is based upon a learning technique called conditioning. The basic idea is that you cannot be highly anxious at the same time you are deeply relaxed. Thoughts about chemistry or the stimuli in the chemistry class environment produce anxiety. If you can somehow be made to relax fully while thinking thoughts about chemistry the battle against anxiety will be won. The more you think of all the concepts surrounding your experience in chemistry while deeply relaxed, the faster the excessive anxiety will disappear. Naturally, a tiny bit of anxiety is probably a good thing - an excessive amount is not. Yo[illegible] task then is to listen to the tapes as directed. This relaxation and desen:itization technique has been done hundreds of times in psychotherapist's offices for excessive fears about anything (airplane travel, elevators, people, insects, high places, sex -- yes, sex, public speaking, test taking, -- literally any type of phobia). The research results published in professional journals are clear -- it works. It not only works but the treatment is short-term with no unnecessary probing about how or why the fear was learned in the first place. That can be explored, but it's not critical to understand how or why in order to treat a present fear.

As far as we know, there has not been an application of this treatment to students who have excessive anxiety about chemistry. So, in a way, we are breaking new ground.

We sincerely hope you are helped by this treatment. Actually, we believe it will help or we probably wouldn't be doing the study. Hopefully, you will have a positive attitude toward the outcome too. (Research has also demonstrated that attitude has a lot to do with outcomes).

Listed on the next page are your detailed instructions. Please follow them to the letter! Thanks.

Dick Rasor and Dominique Engel

APPENDIX B (Continued)

1. You have two tapes, one marked Liberman - relaxation training, Sides 1 & 2; the other Rasor - Chemistry desensitization, Sides 1 & 2. Should you have any problem with these tapes (lost, damaged, etc.) Call Dominique Engel -- 961-9395, 969-9119 or Dick Rasor -- 944-1447,484-8166,484-8224. The first side of each tape is the side with the label. The tape you are to work with first is by Liberman.

2. Select a place in your home that is comfortable and free of routine distraction where you can lie down. Ideally this would be a bedroom. Remember, you are to work alone.

3. Before each training session (lasting about ½ hour) instruct all family members that You are not to be disturbed except for an emergency. Also check the sound level from T.V., radio or children. It is important that you concentrate and not be able to clearly hear any outside noise that will detract from your attention. House members usually cooperate when you tell them how important it is. (you might want to play them a portion of the tape first so they don't feel they're missing anything.) Also disconnect or take the phone off the hook. Try to pick a time of day when you do not have things to worry about.

4. Connect the tape player and adjust the volume so that you can hear the the tape without straining, but don't have it too loud either.

5. Lie down and get comfortable. Start the Liberman tape, side 1 (the side with the label).

To start with, we would like you to practice with the Liberman tape at least once every day. Do this for at least six days (preferably consecutive days). You must play each side of the Liberman tape at least three times to be considered as having received the first phase of "treatment". Ideally, play Side 1 on the first day, side 2 on the second, side 1 on the third, side 2 on the fourth, side 1 on the fifth and side 2 on the sixth day. Certainly use the Liberman tape more often if desired. On the log sheet provided, enter the date and time of each session. (Record keeping is very important for evaluating the outcome of this study).

6. After you have accomplished the goals of Tape 1 (learning to relax), proceed with tape 2, Rasor's chemistry desensitization.

7. The directions are nearly the same for the Rasor tape as for the Liberman tape. You are to listen to both sides of the tape at least three times. This is the definition of having received "treatment." The difference in the directions is that with the Rasor tape, you may listen to as much as you want during each session. Follow the directions on the tape. The idea is to listen to the scenes being described by Rasor's voice until you feel no tension or anxiety. Then allow yourself to proceed to the next scene. There will be several scenes described on each side of the Rasor tape.

After you have played both sides of the Rasor tape at least three times, you are finished with the treatment. Naturally, you may (and should) replay any part or all of the tapes should you experience any return of anxiety (like before tests or labs). As before, please record the date and times on your log sheet.

Good luck

APPENDIX B (Continued)

LOG SHEET

_____ Name

Corwin or Backus? _____ Class

Record for each session, the date, the beginning time and ending times. A "session" is defined as listening to one side of the Liberman tape. A "session" for listening to Rasor's tape is simply 20 minutes or more regardless of what scene is being described.

Liberman tape

Date	Beginning time	Ending time	Date	Beginning time	Ending time

Rasor tape

Date	Beginning time	Ending time	Date	Beginning time	Ending time

APPENDIX C

Belief and Feelings about Chemistry

Instructions: Rate EACH statement below on how strongly you agree or disagree using the following scale:

1	2	3	4	5	6	7
Very strongly disagree	Strongly disagree	Disagree somewhat	Neutral	Agree somewhat	Strongly agree	Very strongly agree

-----1. I'm afraid that I might not do very well in this course.

-----2. Looking at formulas that I don't understand yet makes me feel nervous.

-----3. I'm worried that this course will be a bad experience for me.

-----4. I feel just as confortable in this chemistry class as I do in any of my other classes.

-----5. I'm confident that by the end of the semester I will be able to discuss chemistry intelligently.

-----6. I'm afraid that my work in this course won't earn the grade I want.

-----7. I start to feel tense when I read my chemistry book.

-----8. When I think about taking a major exam in this course I feel nervous.

-----9. I am confident that I will benefit a great deal from this course.

----10. Sometimes when I am trying to make sense out of a chemical formula or equation I get confused and can't think clearly.

----11. I believe that I will master most of the material presented in this course.

----12. I worry about this course a lot even when I am doing other things.

----13. I am afraid that I may not even pass this course.

----14. I am looking forward to getting involved in the more advanced part of this course.

----15. I sometimes feel that I just don't have the background necessary to succed in this course.

----16. I expect to understand all of the reading without too much trouble.

----17. I sometimes lose sleep thinking about my chemistry course.

----18. I'm concerned that I will not be able to follow the lectures very well.

----19. I worry about not being able to get caught up if I miss a class.

----20. Chemistry is inherently a very difficult subject.

APPENDIX D

Anxiety Questionnaire

The next set of questions regards your feelings about classroom tests in general. Please take the time to read each item thoroughly and answer it as accurately as possible. On each item, please indicate your degree of agreement with that statement on a scale of 1 to 7. A score of 1 would mean that you do not agree with the statement at all, and 7 would mean that you agree with it very strongly. Any number between 1 and 7 indicates partial agreement with the item.

1	2	3	4	5	6	7
Very strongly disagree	Strongly disagree	Disagree somewhat	Neutral	Agree somewhat	Strongly agree	Very strongly agree

-----1. I work most effectively under pressure, as when the task is very important.

-----2. When I don't do well on a difficult item at the beginning of an exam, it tends to upset me so that I block on even easy questions later on.

-----3. While I may (or may not) be nervous before taking an exam, once I start, I seem to forget to be nervous.

-----4. I find myself reading exam questions without understanding them, and I must go back over them so that they will make sense.

-----5. Nervousness while taking a test helps me do better.

-----6. Time pressure on an exam causes me to do worse than the rest of the group under similar conditions.

-----7. When I start a test, nothing is able to distract me.

-----8. I am so tired from worrying about an exam, that I find I almost don't care how well I do by the time I start the test.

-----9. In courses in which the total grade is based mainly on one exam, I seem to do better than other people.

----10. I find that my mind goes blank at the beginning of an exam, and it takes me a few minutes before I can function.

----11. I look forward to exams.

----12. During exams or tests, I block on questions to which I know the answers, even though I might remember them as soon as the exam is over.

----13. Although "cramming" under pre-examination tension is not effective for most people, I find that if the need arises, I can learn material immediately before an exam, even under considerable pressure, and successfully retain it to use on the exam.

----14. The more important the examination, the less well I seem to do.

----15. I enjoy taking a difficult exam more than an easy one.

----16. When I am poorly prepared for an exam or test, I getupset, and do less well than even my restricted knowledge should allow.

----17. The more important the exam or test, the better I seem to do.

----18. Nervousness while taking an exam or test hinders me from doing well.

Personal Data Information

For Research Purposes

NAME: _____

ADDRESS: _____

(this information

PHONE: _____ to be kept confidential)

AGE: _____

SEX: M____ F____

MARITAL STATUS: SINGLE_____ MARRIED_____ DIVORCED_____ WIDOWED_____

1st Semester in college? Yes____ No____

Returning Student? Yes____ No____

There is a series of cassette recordings (about 2 hours in total length) designed specifically to reduce excessive anxiety about chemistry and to promote bodily relaxation. Would you agree to use the tapes as directed (several ½ hour sessions) if they were provided free to you ?

YES_____ NO_____ NOT SURE_____

Do you have a cassette tape player at home ? YES_____ NO_____

If NO, would you be willing to buy one to participate in the program ?

YES_____ NO_____

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